Module 5A -- Design Considerations → Instructors Guide

M5A.1: Cover Slide (3 min)

Module 5A
Design Considerations

Delivery:

- Brief introductory comments
- First of three modules relating to the deployment, operations, and management of ITS elements
- Presented in sequence, but represents an iterative process because:
  - Operations and management approach impacts procurement and design
  - Procurement approach has major impact on design
  - ITS elements are not effective unless they are effectively managed (must be considered throughout the planning and development process)
- Deployment of ITS is likely to be done in stages
- Future expansion requires special planning to ensure long term compatibility due to rapidly changing nature of computing, electronic, communications and technologies.
- Deployment and operation of ITS is outside the normal skill areas of many operating departments and requires new approaches to doing business

Output:

- N/A

M5A.2: Challenges (3min)

Challenges

- Meet operational goals
- Cost-effective over time
- Expand
  - Geographically
  - Functionally

Delivery:

- Review of six (6) representative challenges (3 on this and subsequent slide)
- 1st bullet
  - *Design is directly related to the desired operational goals that have been set for the project*
  - *This point must be in the forefront throughout deployment*
  - *The question; "What are we trying to achieve" drives the process, not; "What technology is available?"*
- 2nd bullet
  - *Raises the issue of "life cycle costing"*
  - *When making design decisions for ITS projects, consider the likelihood of operations and management costs exceeding initial capital costs*
  - *Life cycle costing raises the issue of alternative procurements, such as leasing or shared resources*
- 3rd bullet
  - *Initial design must consider the need for expansion since most ITS systems will be deployed in stages*
  - *Consider geographic expansion, or area of coverage*
  - *In ITS, consider the likelihood of adding features, or functions to the systems.*
  - *Each of these require careful consideration*

Output:

- N/A

Notes:

- Key message in discussing the challenges is:
    - *"ITS is different and does require the deploying agencies to think outside the box"*

M5A.3: Challenges (cont.) **(3 min)**

Challenges (cont.)

- Provide regional/national compatibility
- Leading edge vs. bleeding edge
- Continue institutional coordination/ cooperation

Delivery:

- Continue discussion from previous slide
- 1st bullet
  - *Reinforces earlier statements*
  - *ITS projects will generally be deployed in a regional context and involve a number of agencies*
  - *Many of the elements will also need to consider developments occurring nationwide*
  - *Ensuring compatibility between regional and national developments will maximize the potential of ITS*
- 2nd bullet
  - *Risks involved in deploying a high technology system*
  - *Use care in design process to assess the appropriate level of risk*
  - *Stay close to the "state-of-the-art" as practical to avoid obsolescence but...*
  - *Being too ahead of the "state-of-the-art" may cause exposure to too much risk → "the bleeding edge"*
  - *Leading edge → use of "state-of-the-art" technology that satisfies the necessary functional and performance requirements, is cost-effective over time, and can be easily/adequately operated and maintained*
  - *Bleeding edge → use of technology which is <u>not</u> 100% "proven" in that its ability to meet the necessary functional and performance requirements is suspect, its ability to be cost-effective over time is*

unknown (this aspect needs to be evaluated), and its operations and maintenance needs are beyond the "norm"

- 3rd bullet
    - *Most ITS deployments will involve a number of agencies*
    - *Agencies working together to plan the program*
    - *Continued institutional coordination and cooperation is critical throughout the deployment process*
    - *Design and operations and management stages will pose more complex issues that must be resolved through an agreed institutional framework*

Output:

- N/A

Notes:

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M5A.4: Discussion Questions **(10 min)**

Discussion Questions

- How do we ensure that the deployed system will meet our operational goals?
- How do we design for regional compatibility and expandability?
- What do we need to consider to ensure cost-effectiveness over time?

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Delivery:

- Ask each question and record participant responses on flip charts **(FC-6A-1, FC -6A-2, FC -6A-3)**
- Use the following points to help stimulate discussion
- Question #1
    - *Has no "correct" answers in a traditional context*
    - *How do you proceed from concept to requirements to design to operations and management without forgetting what you set out to do*
    - *Point to the need for continuing involvement of the institutions which have been developed in the earlier stages*
    - *The "aspect" between concept and design in the National ITS Architecture is referred to as "traceability" and a process is described in the documents developed under that program*
    - *Record participant answers on a flip chart **(FC -6A-1)***
    - *Continue to raise additional points as needed and move on to the next question*

FC-6A-1

Ways to ensure deployed systems meet their operational goals
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- *Possible answers*
    - *Document agency/system goals and objectives*
    - *Document agency/system "concept-of-operations" (i.e., operational objectives)*
    - *Document information sharing needs with regional agencies*
    - *Establish functional and performance requirements on the "concept-of-operations"*
    - *Perform "verification and validation" (V&V) testing on agency/system operations*
    - *"Trace" agency/system performance to concept-of-operations, functional capabilities, and requirements*

- Question #2
    - *To achieve ITS benefits (e.g., coordinated response to incidents, etc.) regional system compatibility is required*
    - *Raise a specific example (e.g., regional traveler information system, etc.) and ask how to achieve regional compatibility*
    - *Need for "integration" across the various elements of ITS (e.g., regional, multi-agency, multi-functional, etc.)*
    - *Record participant's answers on a flip chart **(FC-6A-2)***
    - *Continue to raise additional points as needed and then move on to next question*

FC-6A-2

Ways to design for regional compatibility & expandability

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    - *Possible answers*
        - *Design systems to handle future expansion --> functionally and geographically*
        - *Involve all regional stakeholders from <u>day one</u>*
        - *Agree to a program and key design features on a regional basis*
        - *Use standards and protocols where applicable (e.g., CD's playing in a variety of manufacturer equipment, etc.)*
        - *Use "open" versus "proprietary" systems (and system interfaces) to make it easier to expand or extend the systems*
        - *Product support by vendor/agency throughout long-term*
        - *Procure "commercial-off-the-shelf" (COTS) products (hardware and software)*
        - *Support/cost-share research and development (R&D) efforts (hardware and software)*
        - *Use of standard communications protocols*
        - *Agreed-upon placement/location of ITS components*
        - *Agreed-upon desire to integrate "individual" agency systems with other ITS projects in the region*
        - *National ITS Architecture makes it easier for agencies to accomplish this goal → coming up soon…*
- Question #3
    - *Alternative procurement approaches and life cycle costing*
    - ***ASK:***
        - *"What costs elements should we consider if we are to compare costs over a ten-year (10-yr) period?"*
        - *Possible answers*
            - *Staffing*
            - *Training*
            - *Maintenance*

        - *"Disposables" (e.g., products, systems, devices, etc.)*
        - *Space rental or construction and maintenance*
        - *Replacement of aging electronic systems*
        - *Software maintenance*
- ***ASK:***
    - *"Are there alternatives to direct purchasing of an ITS service that might offer a different cost structure for consideration?*
    - *Possible answers*
        - *Lease*
        - *Lease-to-purchase*
        - *Shared resources (i.e., cost-sharing)*
        - *Public/private partnering*
        - *Franchise*
- ***ASK:***
    - *"What process would you consider in comparing the costs of alternative approaches?"*
    - *Possible answers*
        - *Life-cycle costing*
        - *Operations and management "level-of-difficulty"*
        - *Procurement (COTS) vs. R&D*
        - *Use of standard communications*
- Discuss each of the questions and list participant responses on a flip-chart **(FC-6A-3)**
- Instructor may raise additional points (as appropriate) based on participant feedback → comments above offer several of the points that may be made

FC-6A-3

Considerations to ensure cost effectiveness

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Output:

- Three (3) flip charts **(FC-6A-1, FC-6A-2, FC-6A-3)** covering participant responses to each of the three primary questions

Notes:

- Results of this exercise are impacted by participant participation
- Watch the time! Don't get bogged down on one question…

M5A.5: Discussion Question (cont.) (3 min)

Discussion Questions (cont.)

- What is the role of the National ITS Architecture in all of this?

Delivery:

- The National ITS Architecture was developed as a tool to assist regions in answering specific questions.
- **ASK:**
  - "What is your impression of the National ITS Architecture and how it might help in the deployment process?"
- Use a flip chart to record participant responses **(FC-6A-4)**

FC-6A-4

Impressions of National ITS Architecture	How can it help in deployment
•	•
•	•
•	•
• ↓	• ↓

- Possible responses may include:
  - "We don't know anything about the National ITS Architecture so we can't respond"
  - I don't understand the National ITS Architecture → its in a foreign language!"

- Refrain from offering judgments on the National ITS Architecture
- Stress the importance of knowing some of the issues
- Basically, most of the possible answers to this slide are included on subsequent slides --> therefore, tell the participants to come-up with their own answers and that the "school solutions" will soon follow...

Output:

- Flip chart **(FC-6A-4)** with participant comments

Notes:

- This is not a class on the National ITS Architecture
- However, it is important for participants to begin to understand the role of the architecture as a tool in both assessing the ITS components that they might select for a region and in deploying the selected elements so that they are compatible
- The key is not to get into an argument about the architecture and whether it is "imposed" on the regions

M5A.6: National ITS Architecture Purpose (3 min)

National ITS Architecture Purpose

- To ensure that ITS consumer devices will work consistently throughout the nation
- Developed as a consensus of public and private sector stakeholders
- Covers current and envisioned ITS user requirements 20 years into the future

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Delivery:

- Provide "mapping" between the requirements a region identifies/selects and the systems that may be used to meet the requirements
- The architecture serves as a tool to allow a user to identify the hardware and software components that might be used to satisfy a specific requirement
- Reinforce the idea of moving from a concept of "how the transportation system should perform" to "systems which may be implemented to support the concept"
- The architecture has done the "homework" on how to move from the concept to the system

Output:

- N/A

Notes:

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M5A.7: National ITS Architecture Development Principles (3 min)

National ITS Architecture Development Principles

- Technology and vendor independent
- Market driven standards and protocols
- Choice in price/performance/functionality
- Ability to leverage existing infrastructure

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Delivery:

- 1st bullet
  - The National ITS Architecture can ensure that the systems installed today will be compatible with those installed in surrounding areas and with other ITS components installed in the future
- 2nd bullet
  - Build on the "mapping" noted previously → the National ITS Architecture has divided the potential systems into clearly identified components that can be installed
  - Components need to be coordinated with one another → the architecture identifies the interface needs and protocols used to provide the desired level of integration
  - Identifies the needed standards
  - Standards Development Organizations, such as the Society of Automotive Engineers, develop standards which can be used by a local agency as it moves into design
- 3rd bullet
  - Choices are a local design decision
  - National ITS Architecture states "what functions must be performed" <u>not</u> "how shall these functions be performed"

- 4th bullet
    - The National ITS Architecture also provides a design process which can be used by a local agency after they have identified their operational requirements

Output:

- N/A

Notes:

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M5A.8: National ITS Architecture Development Principles (3 min)

National ITS Architecture Development Principles (cont.)

- Flexible public/private roles and responsibilities
- Information privacy protection
- Incremental implementation/upgrade/expansion
- Progressive levels of integration

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Delivery:

- 1st bullet
    - Implementing ITS requires a number of agencies to work cooperatively throughout the planning, deployment, and operations and management stages
    - Decide which functions are performed where (i.e., which agency will have responsibility for each required activity)
    - "Institutional Architecture" for a specific regional deployment plan
    - The National ITS Architecture can also serve as a tool for identifying the potential institutional arrangements that may be required to support agreed upon operational concepts and requirements
- 2nd bullet
    - This issue has already been taken into consideration
    - "Sensitive" information flows have been identified and will be "protected" (e.g., user ID, vehicle location, vehicle speed, etc.)
    - Information will only be used for specific transportation purpose(s) or not used at all
- 3rd bullet
    - In breaking the larger systems down into components, multiple uses can be clearly identified, allowing the development of an integrated system from the manageable pieces

- 4th bullet
    - The architecture identifies the relationship of the “pieces”, making it practical to identify those components that should be integrated with others, and identifying the agencies that might be involved

Output:

- N/A

Notes:

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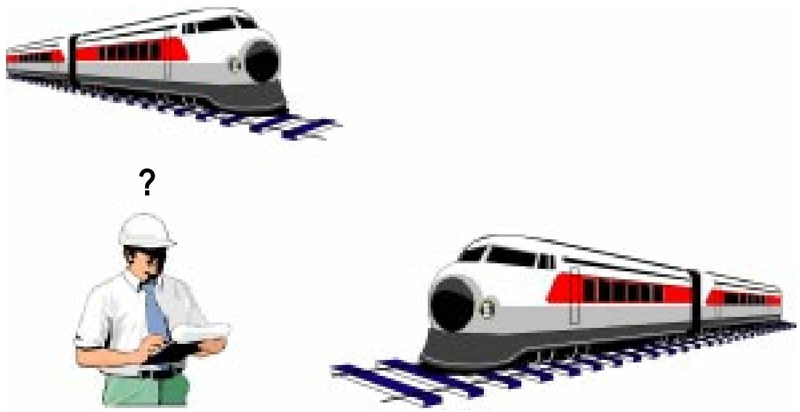
M5A.9 -- Why is an Architecture Needed? (3 min)

Why is an Architecture Needed?



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Delivery:

- Acts as a unifying structure
- Provides a coherent form
- Provides a framework for building something
- Manages complexity
- Deploys “open” systems
- Develops consensus on standards
- Identifies common systems, components, and interfaces
- Reduces risks and costs
- Graphic
    - “Trains” not connecting show the need for an architecture
    - “Tracks” being of a different size show the need for standards
    - The National ITS Architecture helps to identify/accomplish both of these tasks/undertakings at a regional level by using local decision-making

Output:

- N/A

Notes:

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M5A.10 -- National ITS Architecture **(3 min)**

National ITS Architecture

- Defines the basic subsystems, interconnections, data flows, and functions required to make ITS work
- Identifies the interfaces between subsystems for which standards must be developed
- Subsystems commonly depicted in "laymen's terms" through the ITS infrastructure components

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Delivery:

- Major "output" of the National ITS Architecture is the identification of interfaces which require standards
  - Requirements are allocated to subsystems
  - Subsystems interconnected through data flow requirements
  - Requirements expressed in data flow diagrams (DFDs)
- The National ITS Architecture is <u>neutral</u> to which technology, design, or policy is used to implement subsystems
  - National ITS Architecture specifies <u>what</u> the subsystem must do
  - Standards specify <u>how</u> the subsystems must do it

Output:

- N/A

Notes:

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M5A.11 -- National ITS Architecture Structure (1 min)

National ITS Architecture Structure

- User requirements/services
- Market packages
- Logical architecture
- Physical architecture

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Delivery:

- These are the principal components of the National ITS Architecture
- Each bullet will be discussed in more detail on subsequent slides

Output:

- N/A

Notes:

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M5A.12 -- User Requirements/Services **(2 min)**

User Requirements/Services

- Currently 30 user service groupings
- Can be expanded as warranted

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Delivery:

- Originally, 29 “user services” broken-down into seven (7) categories
- Travel and Transportation Management
    - En-Route Driver Information
    - Route Guidance
    - Traveler Services Information
    - Traffic Control
    - Incident Management
    - Emissions Testing and Mitigation
- Travel Demand Management
    - Pre-Trip Travel Information
    - Ride Matching and Reservation
    - Demand Management and Operations
- Public Transportation Operations
    - Public Transportation Management
    - En-Route Transit Information
    - Personalized Public Transit
    - Public Travel Security
- Electronic Payment
    - Electronic Payment Services
- Commercial Vehicle Operations
    - Commercial Vehicle Electronic Clearance
    - Automated Roadside Safety Inspection

    - On-Board Safety Monitoring
    - Commercial Vehicle Administrative Processes
    - Hazardous Materials Incident Response
    - Commercial Fleet Management
- Emergency Management
    - Emergency Notification and Personal Security
    - Emergency Vehicle Management
- Advanced Vehicle Control and Safety Systems
    - Longitudinal Collision Avoidance
    - Lateral Collision Avoidance
    - Intersection Collision Avoidance
    - Vision Enhancement for Crash Avoidance
    - Safety Readiness
    - Pre-Crash Restraint Deployment
    - Automated Highway Systems
- Just added --> 30th “user service”
    - Highway-Rail Intersections
- Not “locked-into” these 30 --> can add, combine, or enhance as local conditions warrant

Output:

- N/A

Notes:

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M5A.13 -- Market Packages **(3 min)**

Market Packages

- Identify which National ITS Architecture subsystems and what equipment is needed to complete representative ITS applications
- Identifies both the logical and physical elements associated with a subsystem
- Provides simple traceability to associated user requirements

Delivery:

- Originally, 56 "market packages" broken-down into seven (7) categories
- Traffic Management
  - Network Surveillance
  - Probe Surveillance
  - Surface Street control
  - Freeway Control
  - HOV and Reversible Lane Management
  - Traffic Information Dissemination
  - Regional Traffic Control
  - Incident Management System
  - Traffic Network Performance Evaluation
  - Dynamic Toll/Parking Fee Management
  - Emissions and Environmental Hazards Sensing
  - Virtual TMC and Smart Probe
  - Standard Speed Railroad Grade Crossing
  - High Speed Railroad Grade Crossing
  - Railroad Operations Coordination
- Emergency Management
  - Emergency Response
  - Emergency Routing
  - Mayday Support

- Traveler Information
    - Broadcast Traveler Information
    - Interactive Traveler Information
    - Autonomous Route Guidance
    - Dynamic Route Guidance
    - ISP-Based Route Guidance
    - Integrated Transportation Management/Route Guidance
    - Yellow Pages and Reservations
    - Dynamic Ridesharing
    - In-Vehicle Signing
- Commercial Vehicles
    - Fleet Administration
    - Freight Administration
    - Electronic Clearance
    - Electronic Clearance Enrollment
    - International Border Electronic Clearance
    - Weigh-In-Motion
    - Roadside CVO Safety
    - On-Board CVO Safety
    - CVO Fleet Maintenance
    - HazMat Management
- Transit Management
    - Transit Vehicle Tracking
    - Transit Fixed-Route Operations
    - Demand Response Transit Operations
    - Transit Passenger and Fare Management
    - Transit Security
    - Transit Maintenance
    - Multi-Modal Coordination
- Advanced Vehicles
    - Vehicle Safety M<onitoring
    - Driver Safety Monitoring
    - Longitudinal Safety Warning
    - Lateral Safety Warning
    - Intersection Safety Warning
    - Pre-Crash Restraint Deployment
    - Driver Visibility Improvement
    - Advanced Vehicle Longitudinal Control
    - Advanced Vehicle Lateral Control
    - Intersection Collision Avoidance
    - Automated Highway System
- ITS Planning
    - ITS Planning

Output:

- N/A

Notes:

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M5A.14 -- Logical Architecture (2 min)

Logical Architecture

- Defines
  - Architecture boundary
  - Functions to be performed
  - Relationships between functions
- Does not define
  - Where the functions are performed
  - How the functions are implemented

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Delivery:

- The National ITS Architecture's "Implementation Strategy" defines a process for applying the architecture definition to the existing and planned transportation systems in the region
- Through this process, the detailed functional requirements and data flows defined in the "Logical Architecture" may be applied to the local system
- Selective application of these detailed requirements can assist in developing functional specifications at varied levels of detail to support ITS product or service planning, procurement, and design
- There should be a high-level of traceability between "Logical Architecture" and "Physical Architecture"
  - The logical and physical architecture are tied together with a collection of cross-reference tables in the "Traceability Matrix"
- Logical Architecture
  - Presents a functional view of the ITS user services
  - This perspective is divorced from likely implementations and physical interface requirements
  - It presents only the functions (process specifications --> p-specs) that are necessary to perform ITS services and information (data flows) that need to be exchanged between these functions
  - Contains diagrams showing processes and data flows between them
  - Also contains a complete data dictionary

M5A.15 -- Physical Architecture **(2 min)**

Physical Architecture

- Describes how functionality is distributed between physical entities
- Defines the physical entity interfaces
- Must correspond/align with physical entity boundaries

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Delivery:

- The National ITS Architecture's "Implementation Strategy" defines a process for applying the architecture definition to the existing and planned transportation systems in the region
- Through this process, the physical subsystems and special constraints identified by the "Physical Architecture" may be applied to the local system(s)
- A regional architecture will facilitate interoperability and inter-agency integration of transportation operations and management
- There should be a high-level of traceability between "Logical Architecture" and "Physical Architecture"
    - The logical and physical architecture are tied together with a collection of cross-reference tables in the "Traceability Matrix"
- Physical Architecture
    - Collects related functions together into subsystems
    - Contains a collection of Architecture Flow Diagrams that show all of the data that passes between subsystems
    - The characteristics and constraints on the inter-subsystem data flows are also presented

Output:

- N/A

Notes:

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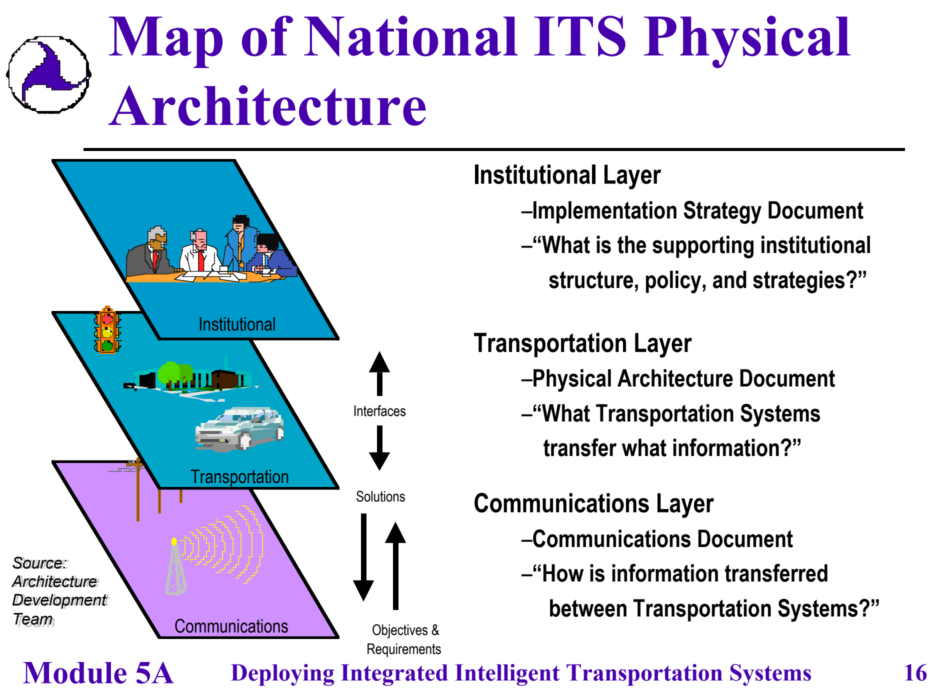
M5A.16 -- Map of National ITS Physical Architecture (3 min)



Delivery:

- The systems are segmented into "layers" of information that address specific issues
    - Underlying institutional framework
    - Common communications framework
    - Specific transportation elements
- This 1st level of "segmentation" allows its unique applications to be identified
    - Compare to the major categories under the "Dewey Decimal System" used by libraries to catalog books

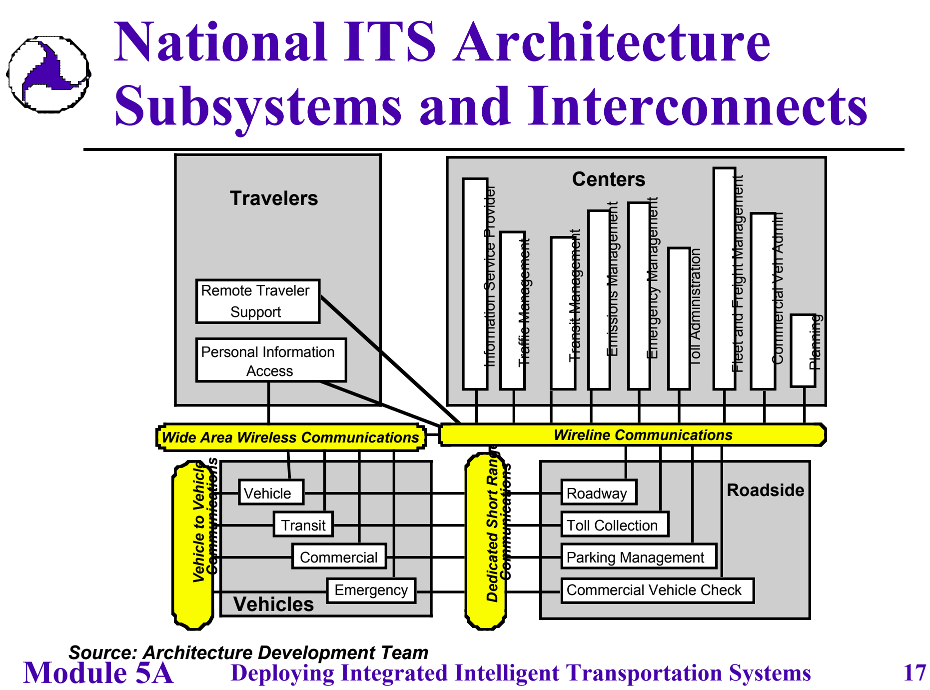
Output:

- N/A

Notes:

- Avoid getting "hung-up" on the details → make simple points and move on
- Use simple points to begin to break down the natural resistance to something that seems as complex as the National ITS Architecture --> it is a very complex system, but it is not difficult to understand or to use at its base level

M5A.17: National ITS Architecture Subsystems and Interconnects (3 min)



Delivery:

- The "sausage diagram" reflects the sausage shape of the communications component that ties together the four (4) major segments
- Most folks have probably seen this diagram before…
- Keep the points simple:
    - Four (4) major subsystems to the architecture → travelers, centers, vehicles, and roadside infrastructure
    - A variety of communications alternatives are applicable to connect each of the four (4) major subsystems
    - These are the major groupings when examining opportunities for coordination and integration
- Instructor facilitates discussion

Output:

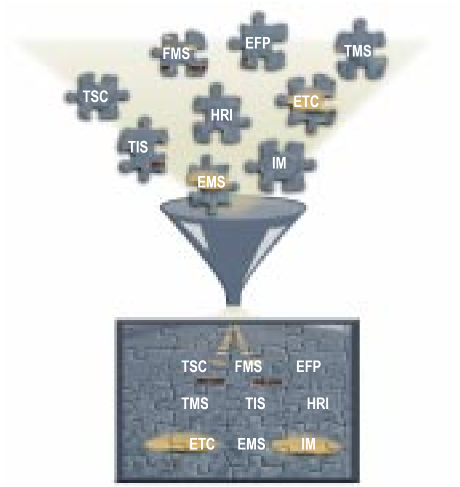
- N/A

Notes:

- Do not get hung up on details → move on...

M5A.18 -- National ITS Architecture Integrates ITS Infrastructure Components (3 min)

National ITS Architecture Integrates ITS Infrastructure Components



TSC - Traffic Signal Control
FMS - Freeway Management Systems
EFP - Electronic Fare Payment
TMS - Transit Management Systems
TIS - Traveler Information Systems
HRI - Highway Rail Intersections
ETC - Electronic Toll Collection
EMS - Emergency Management Systems
IM - Incident Management

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Delivery:

- Currently, there are a number of transportation legacy systems which exist and are in operation
- However, most of these are “stand-alone” systems operated on an agency-by-agency basis
- The need (and benefits) derived from information sharing and integration between these systems on a regional basis should be quite evident by now
- The National ITS Architecture can help to achieve this information sharing and integration

Output:

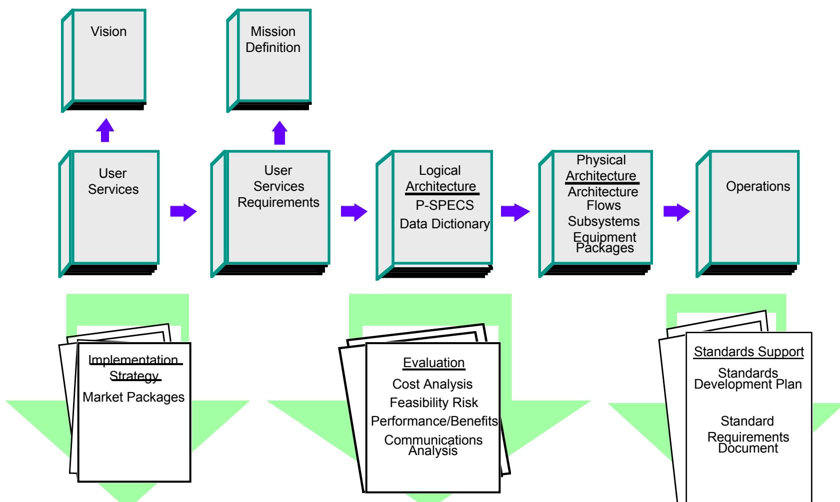
- N/A

Notes:

- Do not get hung up on details → move on...

M5A.19: National ITS Architecture Documentation (3 min)

National ITS Architecture Documentation



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Delivery:

- Documentation is approx. 10,000 pages worth
- Available in CD-ROM format with search tools --> we are handing out CD-ROMs to all interested parties today
- Illustrates the flow of development and deployment under the process used by the architecture
- Closely parallels what was described as the planning, deployment and operations and management phases
- Specifically builds from the requirements that are defined to meet the specific needs, here defined as User Services
- The architecture is a tool to support development of a system that meets the operational needs of a region → it does not start with “hardware” but with “vision”
- National ITS Architecture Documentation (brief synopsis)
    - Mission Definition
        - Ties the architecture to the national program plan and addresses goals, objectives, user service requirements, and expected benefits
    - Vision
        - Magazine style view of what ITS will look like in the future
    - Theory of Operations

- A technical narrative and walk-through of how the architecture supports ITS operations and management

- Logical Architecture
    - A functional view of what is needed to implement ITS
    - This is a large document and defines all of the processes and data flows between processes
    - You will probably only reference this to look at specific functions
    - This document addresses "what" functions need to be done
- Physical Architecture
    - Collects related functions into subsystems and defines the interfaces between subsystems
    - This document addresses "how" subsystems should be connected to make ITS work
- Traceability Matrix
    - Provides a detailed mapping between the logical and physical architecture
    - Used only by those doing detailed analysis
- Communications Document
    - A thorough analysis of the communications requirements of the architecture and ITS including discussion of options for implementation of the various communications links
- Implementation Strategy
    - Discusses examples of how the architecture can be deployed
- Standards Requirements
    - Detailed information regarding standards packages that need to be developed to implement the architecture
- Standards Development Plan
    - Discusses the steps necessary to produce interface standards
    - The audience for this document is primarily the Standards Development Organizations and system designers
- Performance and Benefits Study
    - Discusses the benefits of having and deploying to an architecture
- Cost Analysis
    - Provides unit and system costs for deploying ITS based upon the architecture
- Risk Analysis
    - Assesses risks threatening architecture deployment and presents mitigation strategies for those risks
- Evaluation Summary

        - A summary of the various evaluations conducted during development of the architecture
    - Evaluatory Design
        - Provides a unifying set of assumptions as a basis for the evaluations
- Close with:
    - "The National ITS Architecture does not need to be frightening → it is just another tool to assist those deploying ITS in making smart buying decisions and in implementing components that work together and offer the opportunity for easy expansion → both geographically and functionally"

Output:

- N/A

Notes:

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M5A.20 -- Importance of Standards (2 min)

Importance of Standards

- National ITS Architecture
  - Use as guiding framework
  - Identifies interfaces
  - Specifies what systems perform which functions
- Standards and protocols specify how the subsystems must do it

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Delivery:

- Major issue for ITS deployment is that the interfaces between major subsystems not be proprietary
- Internal operations may be proprietary but with open interfaces

Output:

- N/A

Notes:

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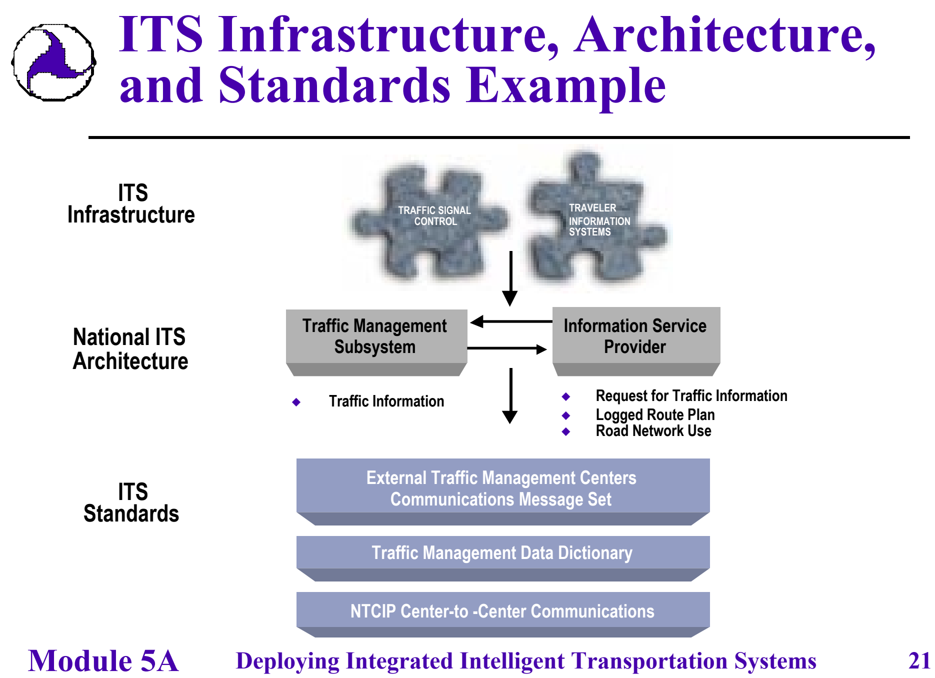
M5A.21 -- ITS Infrastructure, Architecture, and Standards Example



Delivery:

- Graphic illustrates how the ITS infrastructure components, National ITS Architecture, and ITS standards are interconnected/related to one another
- 1st level
  - Depicts two (2) ITS infrastructure components which are desired to share information and be integrated with one another
- 2nd level
  - Depicts the high-level information flows which need to be “passed” between subsystems
- 3rd level
  - Depicts the standards which need to be adhered to in order to allow the integration to be complete
  - NTCIP --> National Transportation Control/Communications ITS Protocol

Output:

- N/A

Notes:

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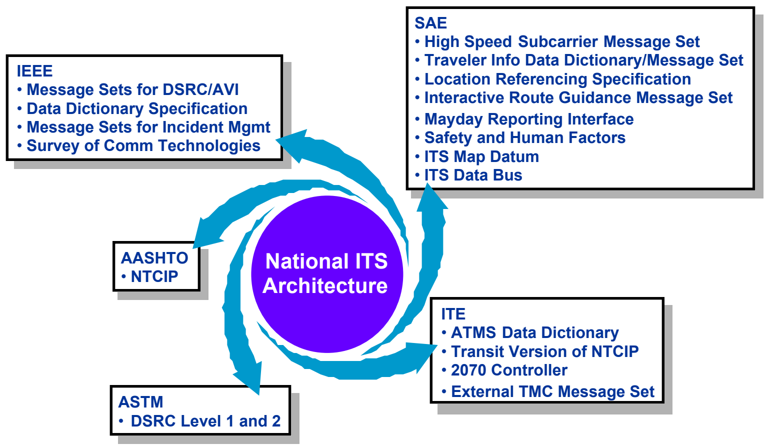
M5A.22 -- Standards Development Organization Support (2 min)

Standard Development Organization Support



Module 5A Deploying Integrated Intelligent Transportation Systems 22

Delivery:

- ITS Standards Development Program
  - Recently initiated by the USDOT
  - Collections of subsystem interfaces have been documented in eleven (11) standards requirements packages
  - Will use standards requirements identified in National ITS Architecture to develop standards in "priority" areas

Output:

- N/A

Notes:

-

M5A.23 -- Benefits of Using the National ITS Architecture (3 min)

Benefits of Using the National ITS Architecture

- Facilitates information sharing and cooperation/coordination across institutional boundaries, enabling agencies to do a better job
- Reduces risk of acquiring incompatible/ dead-end technology

Module 5A Deploying Integrated Intelligent Transportation Systems 23

Delivery:

- Why is the National ITS Architecture important to ITS?
  - Maximizes value of investments
  - Provides common starting point
  - Supports ranges of functionality
  - Institutional flexibility/local choice
  - Can save local transportation agencies time, money, and effort
  - Provides a roadmap to design
  - Open systems and standard interfaces
  - Multiple suppliers/competitive markets
  - Future growth
  - Reduce risk and cost
  - National compatibility, synergy, and integration

Output:

- N/A

Notes:

-

M5A.24 -- Benefits of Using the National ITS Architecture (cont.)
(3 min)

Benefits of Using the National ITS Architecture (cont.)

- Facilitates integrated deployment with simple "pick-n-choose" capabilities
- Reduces system engineering and development time by up to a factor of four
  - Denver, CO example

Module 5A Deploying Integrated Intelligent Transportation Systems 24

Delivery:

- Short-term benefits
  - Rapid development
    - Logical architecture
    - Physical architecture
  - "How-to-integrate" guidance
    - Implementation plan
  - Incorporates institutional considerations
    - Developed using a consensus process with stakeholder input and review
- Long-term benefits
  - A 20-year consensus view
    - Enable flexible public/private sector roles
    - Future "spin-off" of public functions to the private sector
  - Stable standards will achieve vendor flexibility for replacement/upgrade
    - Anticipate future upgrade or expansion

Output:

- N/A